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# Towards a methodology for routinely assimilate ocean colour data into a NEMO-PISCES operational solution

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One of the core projects of the Copernicus Marine Environment Monitoring Service (CMEMS) is the operational production of data-assimilated biogeochemical estimations of the ocean state with associated uncertainties. Currently, satellite ocean colour are the only observations of marine biogeochemistry with routine global coverage, yet still incomplete and limited to the sea surface. Even so, the assimilation of satellite ocean colour data has been shown to improve the simulation of nutrients and primary production. In this framework, the present work introduces a novel methodology that relies on the assimilation of ocean colour observations into a probabilistic solution of the Mercator Ocean North Atlantic 1/4º configuration of the NEMO-PISCES coupled model. Starting from a deterministic simulation of PISCES, we introduce stochastic perturbations into the model formulations to simulate (1) uncertainties in the biogeochemical parameters that directly impact the inferred primary production, and (2) uncertainties related to unresolved scales (Garnier et al., 2016). A 60-members ensemble simulation is performed from the resulted probabilistic simulation, and used afterwards as the prior probability density function (PDF) for the assimilation experiment. 1-day MERIS ocean colour observations are then assimilated to daily update the 60-members ensemble forecast from the analysis ensemble using a Singular Evolutive Extended Kalman (SEEK). Biogeochemical state vectors are selected according to the correlations between each model variable and chlorophyll (used here as a proxy for primary production). To ensure that the marginal PDFs of each variable is close to Gaussian, anamorphosis transformations are applied to each variable of the state vector prior to the ensemble analysis step, while the corresponding inverse transformation to come back into the original model space are performed after analysis (Brankart et al., 2012). In this presentation, we will asses this novel approach, and quantify the impact of assimilated ocean colour data on relevant biogeochemical variables of the analysis and forecast ensembles.

References:
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